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Dual-Beam Interferometer Development and Validation

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LONG-TERM GOALS

My long-term goal is to contribute to our understanding of the upper ocean and lower atmosphere through the development and application of microwave, acoustic, and optical remote sensing techniques.

OBJECTIVES

The objective of this effort is to develop an instrument and techniques to estimate surface current vectors from aircraft using along-track interferometry.

APPROACH

Our approach is to design and develop a low-cost dual-beam interferometric radar termed the Dual-Beam Interferometer (DBI). The radar concept is that of an along-track interferometric SAR producing two beams, one squinted forward and one squinted aft. Such a concept was originally proposed by Rodriguez et al. (1995). The two interferometer beams yield two components of the surface Doppler velocity from which surface current is estimated. The instrument is to be packaged into a wing-mounted pod suitable for mounting on NOAA WP-3D research aircraft, or other aircraft with compatible mounting pylons. Testing of the instrument is planned in the context of NOAA/HRD's air-sea interaction experiments and other planned operations in 2002.

WORK COMPLETED

Construction of the radar electronics was led by graduate student Juan Capdevila. An aircraft-quality instrument chassis has been designed and constructed. In October, it will be shipped to the pod manufacturer (Zivko Aeronautics) who will provide the shell.

RESULTS

Figure 1 is a 3D CAD model of the instrument in the pod chassis (pod shell not shown). Most of the radar electronics are contained in the payload area located between supports for the microstrip patch array antennas. The baseline between antennas is approximately 1 m.

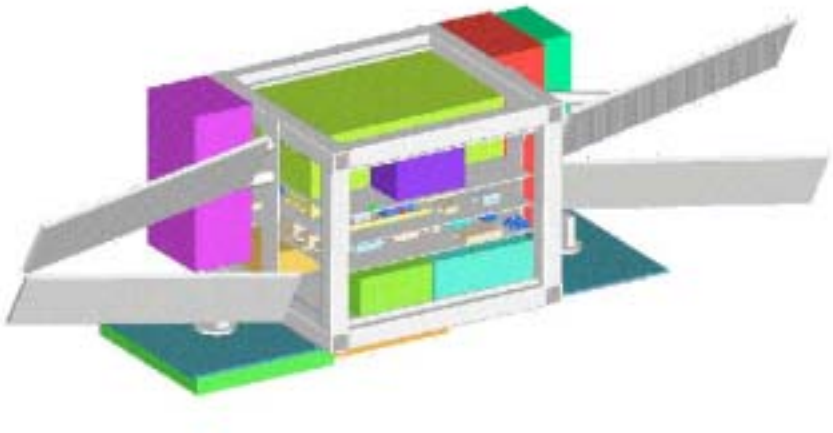

Figure 1: 3D CAD model of the DBI instrument in the pod chassis (pod shell not shown).

IMPACT/APPLICATIONS

Along-track interferometric SARs commonly provide a single component of surface Doppler velocity. The ability to obtain surface velocity vector estimates in a single aircraft pass would permit long distance strip mapping of current vectors in, for example, coastal regions.

TRANSITIONS

None.

RELATED PROJECTS

Using the FOPAIR imaging radar developed at UMass, we are also investigating the utility of imaging Doppler radar for use in estimating currents and wave heights within and just beyond the surf zone.

REFERENCES

Rodriguez, E., D. Imel, B. Houshmand, 1995: “Two Dimensional Surface Currents Using Vector Along-Track Interferometry”, PIERS’95 Proceedings, Seattle, WA, p. 763.

PUBLICATIONS

Frasier, S.J., and A.J. Camps, 2001: “Dual-Beam Interferometry for Ocean Surface Current Vector Mapping”, *IEEE Trans. Geosci. & Rem. Sensing*, **39**(2), 401–414.